



# Disaster Risk Reduction: From Integrated Research to Effective Risk Management

**International Workshop on Governance of Climate-related Risks in Europe: the need for policy-oriented research  
Brussels, 8-9 September 2011**

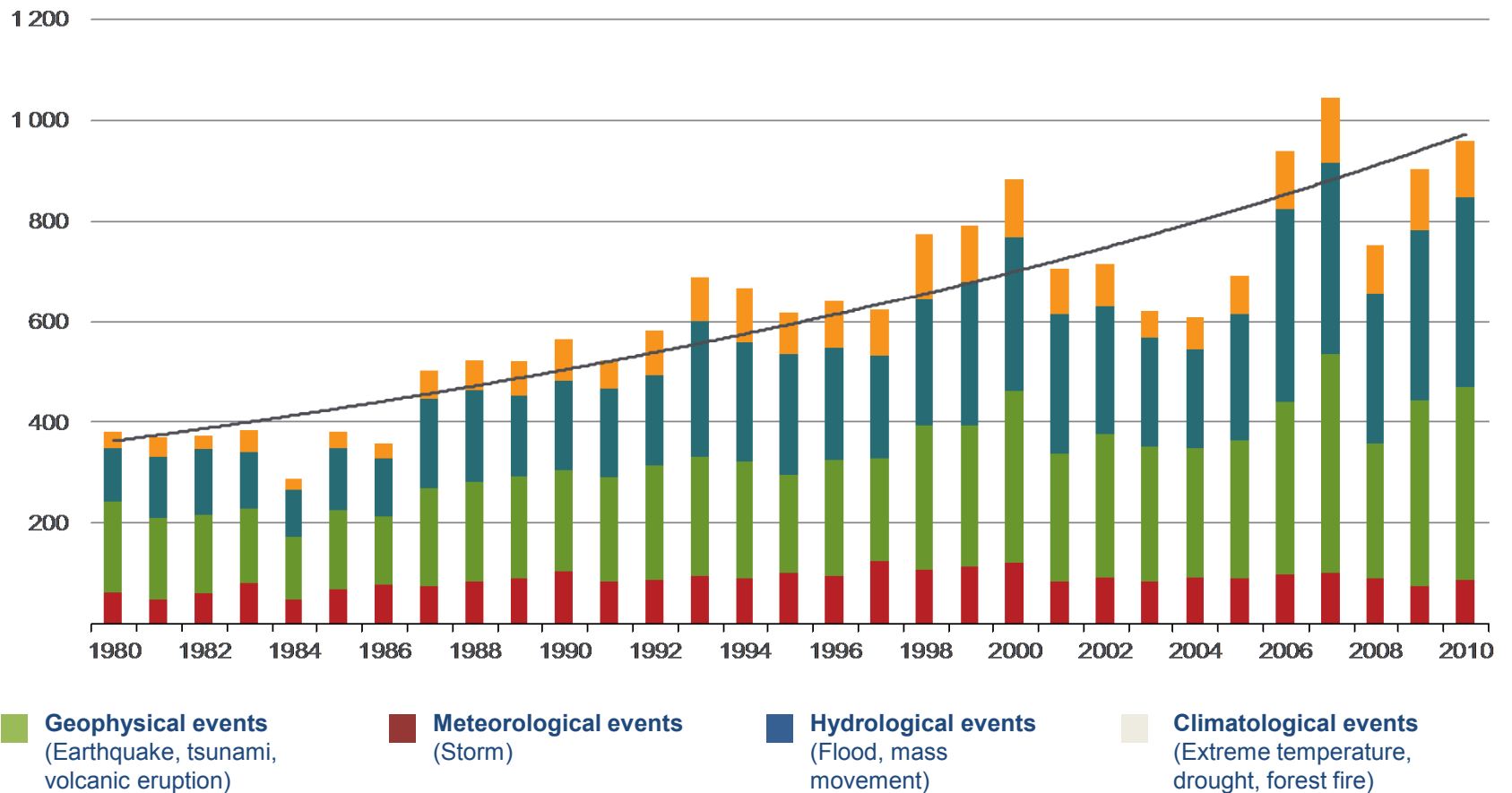
**Sálvano Briceño  
Chair-elect, Science Committee, IRDR**



# Natural catastrophes worldwide 1980 – 2010

## Number of events with trend

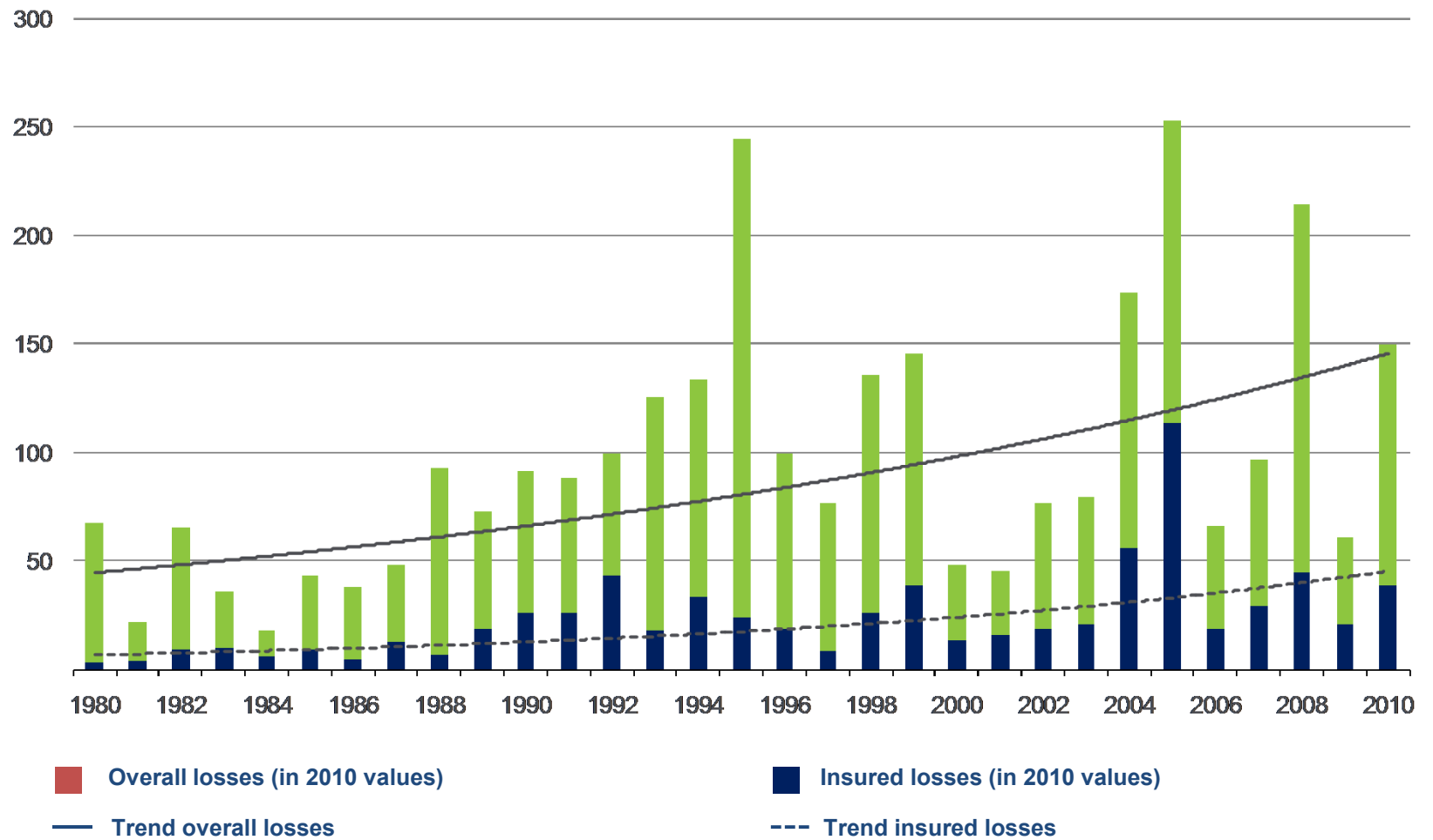
Number



# Natural catastrophes worldwide 1980 – 2010

## Overall and insured losses with trend

(bn US\$)



**Significant natural catastrophes worldwide 1980 – 2010**  
**10 costliest natural catastrophes ordered by overall losses**

Period	Event	Affected Area	Overall losses	Insured losses	Fatalities
			US\$ m, original values		
25-30.8.2005	Hurricane Katrina	USA: LA, New Orleans, Slidell; MS, Biloxi, Pascagoula, Waveland, Gulfport	125,000	62,200	1,300
17.1.1995	Earthquake	Japan: Hyogo, Kobe, Osaka, Kyoto	100,000	3,000	6,400
12.5.2008	Earthquake	China: Sichuan, Mianyang, Beichuan, Wenchuan, Shifang, Chengdu, Guangyuan, Ngawa, Ya'an	85,000	300	84,000
17.1.1994	Earthquake	USA: Northridge, Los Angeles, San Fernando Valley, Ventura, Orange	44,000	15,300	60
6-14.9.2008	Hurricane Ike	USA. Cuba. Haiti. Dominican Republic. Turks and Caicos Islands. Bahamas	38,300	18,500	170
May-September 1998	Floods	China: Jangtsekiang, Songhua Jiang	30,700	1,000	4,200
27.2.2010	Earthquake, tsunami	Chile: Bio Bio, Concepción, Talcahuano, Coronel, Dichato, Chillán; Del Maule, Talca, Curicó	30,000	8,000	520
23.10.2004	Earthquakes	Japan: Honshu, Niigata, Ojiya, Tokyo, Nagaoka, Yamakoshi	28,000	760	50
23-27.8.1992	Hurricane Andrew	USA: FL, Homestead; LA. Bahamas	26,500	17,000	60
27.6-13.8.1996	Floods	China: Guizhou, esp. Guiyang; Zhejiang; Sichuan; Hunan; Anhui; Jiangxi; Hubei; Guangxi; Jiangsu	24,000	445	3,050

**Significant natural catastrophes worldwide 1980 – 2010**  
**10 costliest natural catastrophes ordered by insured losses**

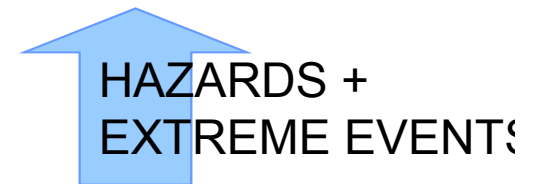
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17.1.1994	Earthquake	USA: Northridge, Los Angeles, San Fernando Valley, Ventura, Orange	44,000	15,300	60
7-21.9.2004	Hurricane Ivan	USA. Trinidad and Tobago. Venezuela. Colombia. Mexico	23,000	13,800	130
19-24.10.2005	Hurricane Wilma	USA. Bahamas. Cuba. Haiti. Jamaica. Mexico	22,000	12,500	40
20-24.9.2005	Hurricane Rita	USA: LA, Lake Charles, Holly Beach, Cameron, New Orleans; MS; TX, Houston	16,000	12,100	10
27.2.2010	Earthquake, tsunami	Chile: Bio Bio, Concepción, Talcahuano, Coronel, Dichato, Chillán; Del Maule, Talca, Curicó	30,000	8,000	520
11-14.8.2004	Hurricane Charley	USA. Cuba. Jamaica. Cayman Islands	18,000	8,000	40
26-28.9.1991	Typhoon Mireille, floods	Japan: Kyushu, Hokkaido, Hakata	10,000	7,000	60

## Significant natural catastrophes worldwide 1980 – 2010 10 deadliest events

Period	Event	Affected Area	Overall losses	Insured losses	Fatalities
			US\$ m, original values		
12.1.2010	Earthquake	Haiti: Port-au-Prince, Petionville	8,000	200	222,570
26.12.2004	Earthquake, tsunami	Sri Lanka. Indonesia. Thailand. India. Bangladesh. Myanmar. Malediven. Malaysia	10,000	1,000	220,000
2-5.5.2008	Cyclon Nargis	Myanmar: Ayeyawaddy, Yangon, Bugalay, Irrawaddy, Bago, Karen, Mon, Laputta, Haing Kyi	4,000		140,000
29-30.4.1991	Tropical cyclon	Bangladesh: Bay of Bengal, Cox's Bazar, Chittagong, Bola, Noakhali districts, esp. Kutubdia	3,000	100	139,000
8.10.2005	Earthquake	Pakistan. India. Afghanistan	5,200	5	88,000
12.5.2008	Earthquake	China: Sichuan, Mianyang, Beichuan, Wenchuan, Shifang, Chengdu, Guangyuan, Ngawa, Ya'an	85,000	300	84,000
July-August 2003	Heatwave, drought	France. Germany. Italy. Portugal. Romania. Spain. United Kingdom	13,800	20	70,000
July-Sept. 2010	Heatwave, drought	Russia	2,000	20	56,000
21.6.1990	Earthquake	Iran: Caspian Sea, Gilan Provinz, Manjil, Rudbar, Zanjan, Safid, Qazvin	7,100	100	40,000
8-19.12.1999	Floods, flash floods	Venezuela: Vargas, La Guaira Punta de Mulatos, Miranda, Nueva Esparta, Yaracuy. Kolumbien	3,200	220	30,000

# Global Trends - Disasters are NOT natural

Greater exposure to natural and human-induced hazards, climate change and variability

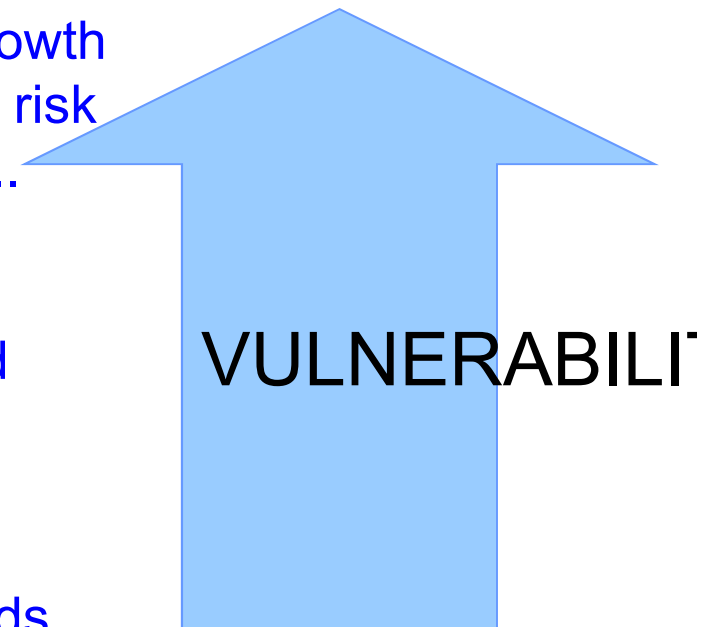


HAZARDS +  
EXTREME EVENTS

Socio-economic: poverty & unsustainable development styles, unplanned urban growth and migrations, lack of risk awareness & risk governance institutions & accountability...

Physical: insufficient land use planning, housing & critical infrastructure in hazard prone areas, little safety awareness...

Ecosystem & natural resource depletion (coastal, mountains, watersheds, wetlands, forests...)



VULNERABILITY

# World Conference on Disaster Reduction

2<sup>nd</sup> WCDR, Kobe, Hyogo, Japan, 18-22 January 2005

## Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters (HFA)

- ✓ 3 Strategic goals
- ✓ 5 Priorities for action
- ✓ Implementation and follow-up

### Expected outcome:

The WCDR resolved to pursue the following expected outcome for the next 10 years: ***the substantial reduction of disaster losses, in lives & in the social, economic & environmental assets of communities & countries***. The realization of this outcome will require the full commitment & involvement of all actors concerned, including governments, regional & international organizations, civil society including volunteers, the private sector & the scientific community.



## Hyogo Framework for Action 2005-2015 (continued)

3 strategic goals:

- The integration of disaster risk reduction into sustainable development policies & planning
- The development & strengthening of institutions, mechanisms & capacities to build resilience to hazards
- The systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response & recovery programmes

## Hyogo Framework for Action 2005-2015 (continued)

### Five priorities for action:

1. Governance: ensure that disaster risk reduction is a national and local priority with strong institutional basis for implementation
2. Risk identification: identify, assess and monitor disaster risks and enhance early warning
3. Knowledge: use knowledge, innovation and education to build a culture of safety and resilience at all levels
4. Reducing the underlying risk factors in various sectors (environment, health, construction, private sector etc.)
5. Strengthen disaster preparedness for effective response

# Key questions:

- Why, despite advances in the natural and social science of hazards and disasters, do losses continue to increase?
- To what extent is the world-wide growth in disaster losses a symptom and indicator of unsustainable development?

# Partners

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- National and international science institutions
- National and international development assistance agencies and funding bodies
- National Committees



# Co-Sponsors

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International Strategy for  
Disaster Reduction

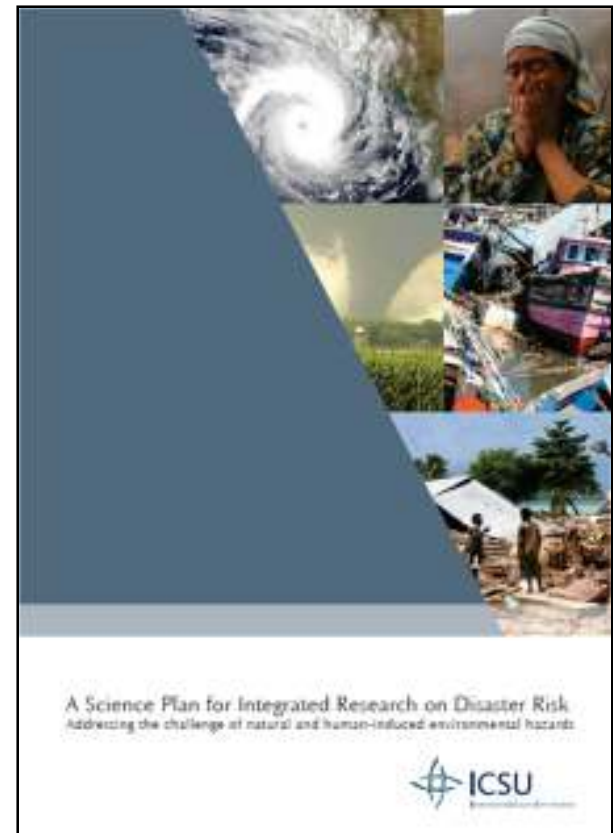


# The Science Plan

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Addressing the challenge of natural and human-induced environmental hazards

An integrated approach to research on disaster risk through: an international, multidisciplinary (natural, health, engineering and social sciences, including socio-economic analysis) collaborative research programme.



**IRDR Science Plan at:**  
<http://www.irdrinternational.org/>

# Scope of IRDR

- **Geophysical, climate and weather-related trigger events**
- Earthquakes – tsunamis – volcanoes – floods – storms (hurricanes, cyclones, typhoons) – heat waves – droughts – wild-fires – landslides – coastal erosion – climate change (increases of extreme events)
- **Effects of human activities** on creating or enhancing disasters, including land-use practices
- Space weather and impact by near-Earth objects
- **NOT** disasters triggered by technological failure (but technological failure triggered by geophysical and climate-weather events), warfare...





## **Objective-1:**

### **Characterization of hazards, vulnerability and risk**

- 1.1: identifying hazards and vulnerabilities leading to risks;**
- 1.2: forecasting hazards and assessing risks; and**
- 1.3: dynamic modelling of risk**
- HFA-2. Identify, assess and monitor disaster risks and enhance early warning**





## Objective 2:

### Effective decision making in complex and changing risk contexts

- 2.1: Identifying relevant decision-making systems and their interactions
- 2.2: Understanding decision making in the context of environmental hazards; and
- 2.3: Improving the quality of decision-making practice
- HFA-1. DRR-national priority
- HFA-5. Strengthen disaster preparedness



# Objective 3:

**Reducing risk and curbing losses through knowledge-based actions**

- **3.1: Vulnerability assessments;**
- **3.2: Effective approaches to risk reduction**
- **Long-term database, monitoring systems and tools**
- **HFA-4. Reduce the underlying risk factors**
- **HFA-3. knowledge - culture of safety and resilience**

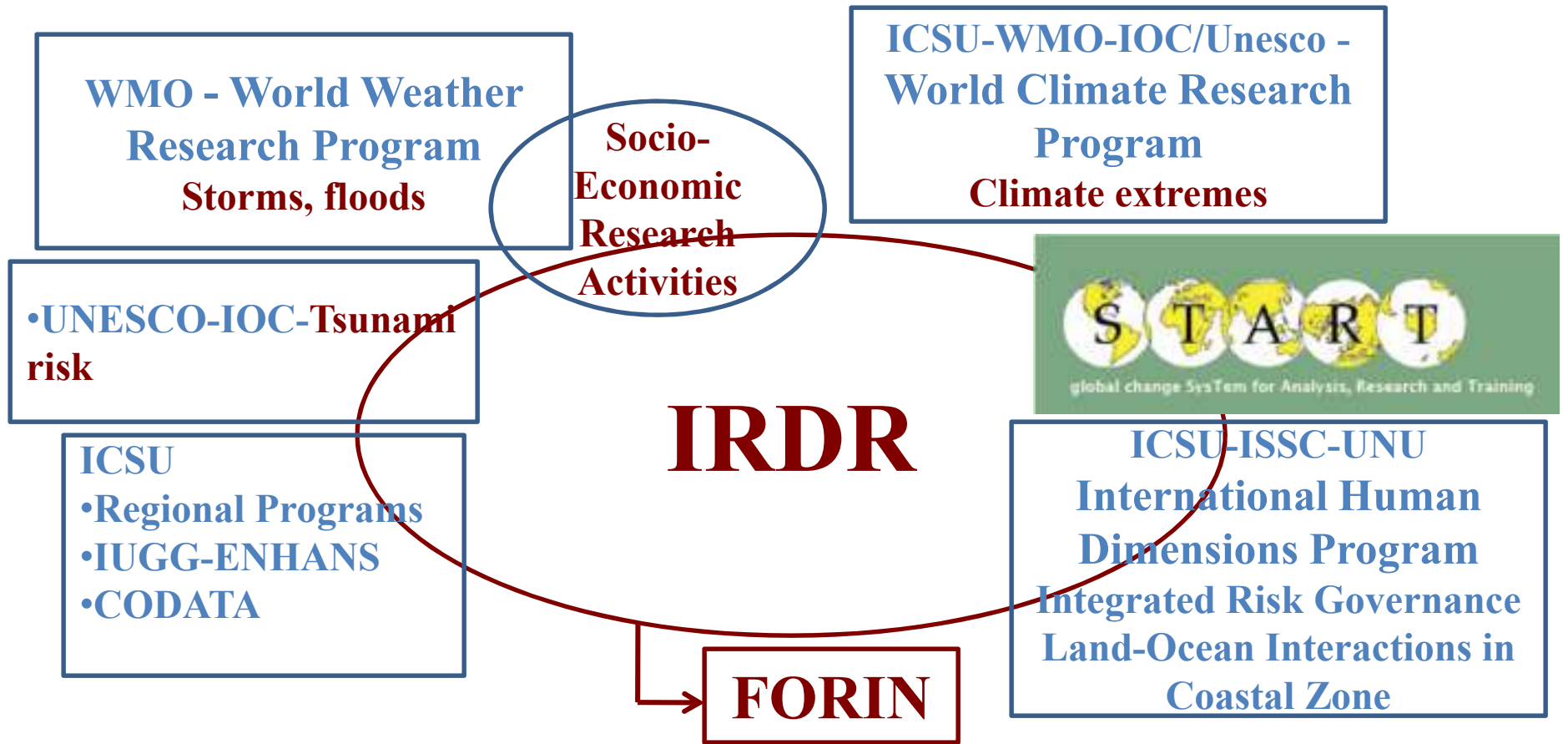
# Cross-Cutting Themes

1. Capacity building
2. Case studies and demonstration projects
3. Assessment, data management and monitoring
  - HFA-2. Identify, assess and monitor disaster risks
  - HFA-1, -HFA-3,- HFA-4, HFA-5...

1...

IPCC Special Report  
on Managing Risk of  
Extreme Climate Events

Inami  
0 hours after earthquake



# Risk Interpretation and Action (RIA)

- What do people (especially those at risk) *think is likely to happen?* & What will they do about it?
- Estimation of the likelihood and magnitude
- Evaluation of the vulnerability/resilience of the physical infrastructure
- Consideration of social and behavioral factors that place the local population at greater or lesser risk



# IRDR Forensic Disaster Investigations (FORIN)

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- Probe further into complex and underlying causes of growing disaster loss
- Fundamental cause of disasters
- Trace out and assign causal explanation of losses
- Intervening conditions that increased or reduce losses
  
- Series of case studies
- Common template and methodology





- **Disaster Loss Data Project (DATA)**
- ... need for more systematic and reliable information on such events. ... generate new information and data and to leave a legacy of coordinated and integrated global data and information sets across hazards and disciplines, with unprecedented degrees of access
- **Assessment of Integrated Research on Disaster Risk (AIRDR)**
- **First systematic and critical assessment of research on disaster risk, provide baseline to measure effectiveness of multiple programmes**



Sponsors: ICSU, ISSC,  
UN-ISDR

IPO

Scientific Committee

Consultative  
Forum

Dr. Jane E. Rovins, Executive Director  
Lang Lang, Administrative Officer  
Anna Rudashko, Communications  
Vacant, Science Officer

...  
Located at CEODE, CAS, Beijing, China  
Development Department of Hong Kong, China  
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EISER, Richard, University of Sheffield, UK –  
FERRIGNI Ferruccio, Naples, Italy  
JOHNSTON, David, Massey University, New Zealand  
LAVELL, Allan, FLACSO, Costa Rica  
McBEAN, Gordon, University of Western Ontario, Canada – CHAIR

OLIVER-SMITH Anthony | University of Florida  
UN ISDR Global Platform  
Geneva, June 2011 (2013, 2015, ...)

Pacific Science Congress - Kuala Lumpur, June 2011

ICSU GA, Rome, September, 2011

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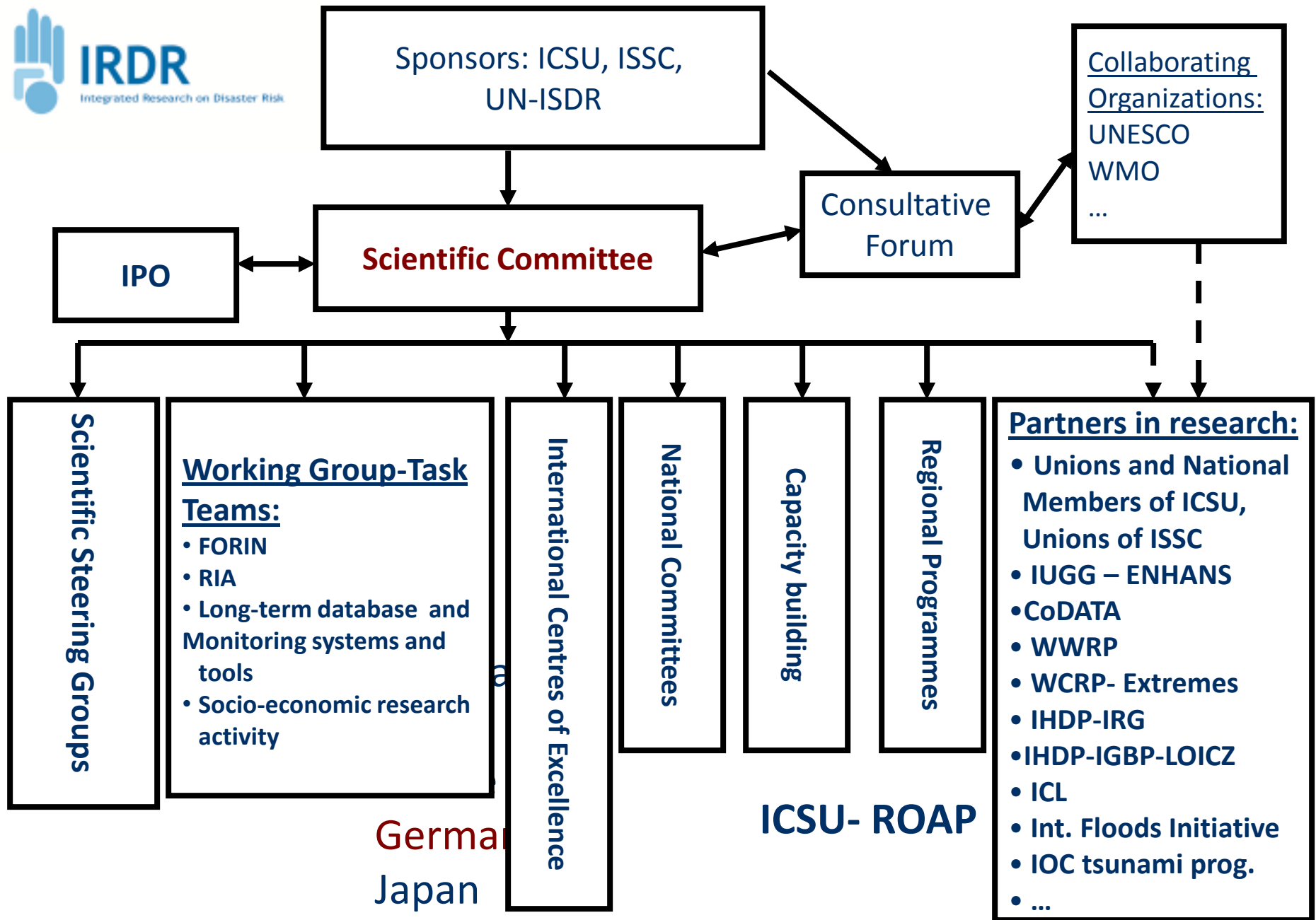
IRDR Conference

E) Beijing , October /November 2011 and

H Planet Under Pressure e

N London, March 2012 ior

M ...  
Science (ISSC)





# IRDR Legacy

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- An enhanced capacity around the world to address hazards and make informed decisions on actions to reduce their impacts.
- 
- Societies to shift focus from response-recovery towards prevention-mitigation, building resilience and reducing risks, learning from experience and avoiding past mistakes.



**IRDR**

Integrated Research on Disaster Risk



# IRDR

Integrated Research on Disaster Risk

## Registration and Abstract Submission Open

SAVE THE DATE



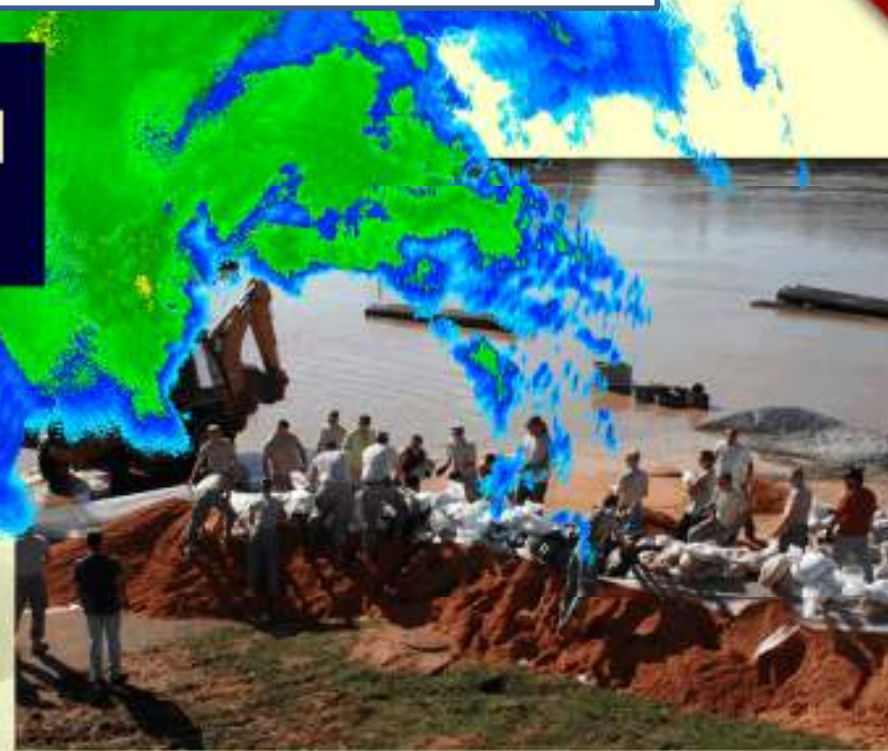
### IRDR Conference 2011

Oct. 31 - Nov. 2, Beijing

[www.irdrinternational.org/conference2011](http://www.irdrinternational.org/conference2011)

*Why, despite advances in the natural and social science of hazards and disasters, do losses continue to increase?*

*To what extent is the world-wide growth in disaster losses a symptom and indicator of unsustainable development?*



# Disaster Risk: Integrating Science & Practice



# **Global Earthquake Model**

**Uniform and Open Standards  
to Calculate and Communicate  
Earthquake Risk**

## THE NEED

Seismic risk mitigation requires accurate, consensual and uniform risk estimates.

Since strong earthquakes know no political boundaries and occur relatively rarely, a global knowledge-sharing approach is required,

which should lead also to the development of socio-economic impact assessment tools, including cost-benefit analysis,

involving both the public and the private sectors, as well as international organisations, professionals associations and the wider community..

**“A collaborative effort devised and launched by the OECD Global Science Forum, aimed at engaging the global community in the design, development and deployment of uniform open standards and tools for earthquake risk assessment worldwide”**



# PUBLIC-PRIVATE PARTNERSHIP

9 countries have  
adhered so far



discussions and  
negotiations are ongoing  
with 15+ others

7 private organisations have  
partnered up with GEM so far

they contribute  
13.6 M Euro



the OECD, WorldBank, UNESCO, UN/ISDR,  
IAEE and IASPEI are associative participants

# PRIVATE PARTICIPANTS

## Founders:

Munich RE  5 Mill. €

  
ZURICH® 3 Mill. €

 AIR WORLDWIDE 1 Mill. €

Willis 1 Mill. €

 EUCENTRE®  
European Centre for Training and Research in Earthquake Engineering 1.6 Mill. €

## Sponsors:

  
1 Mill. €

hannover re®  
1 Mill. €

# PUBLIC PARTICIPANTS



Australia



Belgium



Germany



Italy



New Zealand



Norway



Singapore



Switzerland



Turkey



United Kingdom



# ASSOCIATE PARTICIPANTS



**OECD**

Organization for Economic Cooperation and Development



**WORLD BANK**

The World Bank



**UN-ISDR**

United Nations International Strategy for Disaster Risk Reduction



**UNESCO**

United Nations Educational, Scientific and Cultural Organization



**IASPEI**

International Association of Seismology and Physics of the Earth's Interior



**IAEE**

International Association of Earthquake Engineering

# GLOBAL COMPONENTS

For and from the community..



- **scientific modules** of GEM that are developed at a global scale to provide standards, methods and tools for global datasets
- addressed by **international consortia** that respond to Requests for Proposals (RfPs) released periodically by the Scientific Board
- before consortia are selected there is a thorough process of **expert elicitation, community feedback, and peer review**
- provide the **global framework** for the model which will be reviewed and further developed by the Regional Programmes to ensure they are adequate for regional needs and characteristics

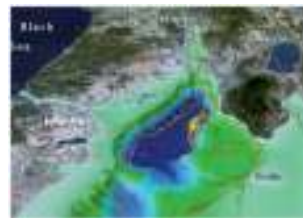
# GEM1

- Pilot project to generate GEM's first products and develop GEM's initial infrastructure

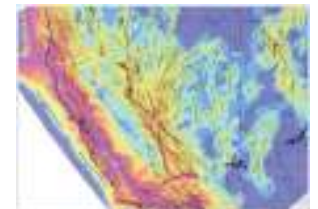


# HAZARD GLOBAL COMPONENTS

- Expert elicitation, 5 Request for Proposals (RfP) drafting and publication
- International consortia submitted 9 proposals (20+ Institutions)
- 14 peer reviewers, Scientific Board selection, Governing Board decision.

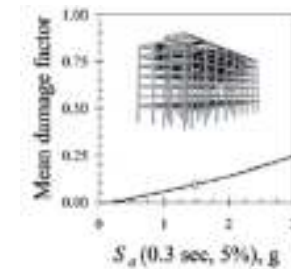
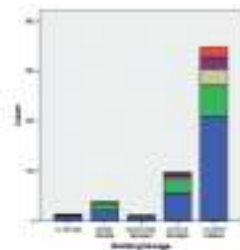


Global Earthquake History  
Global Instrumental Earthquake Catalogue  
Global Active Fault and Seismic Source Database  
Global Ground-Motion Prediction Equations  
Global Geodetic Strain Rate Model



# RISK GLOBAL COMPONENTS

- Expert elicitation, 5 Requests for Proposals (RfP) drafting, community feedback, RfP review and publication
- International consortia submitted 14 proposals (60+ Institutions)
- 20 peer reviewers, Scientific Board selection, Governing Board decision.



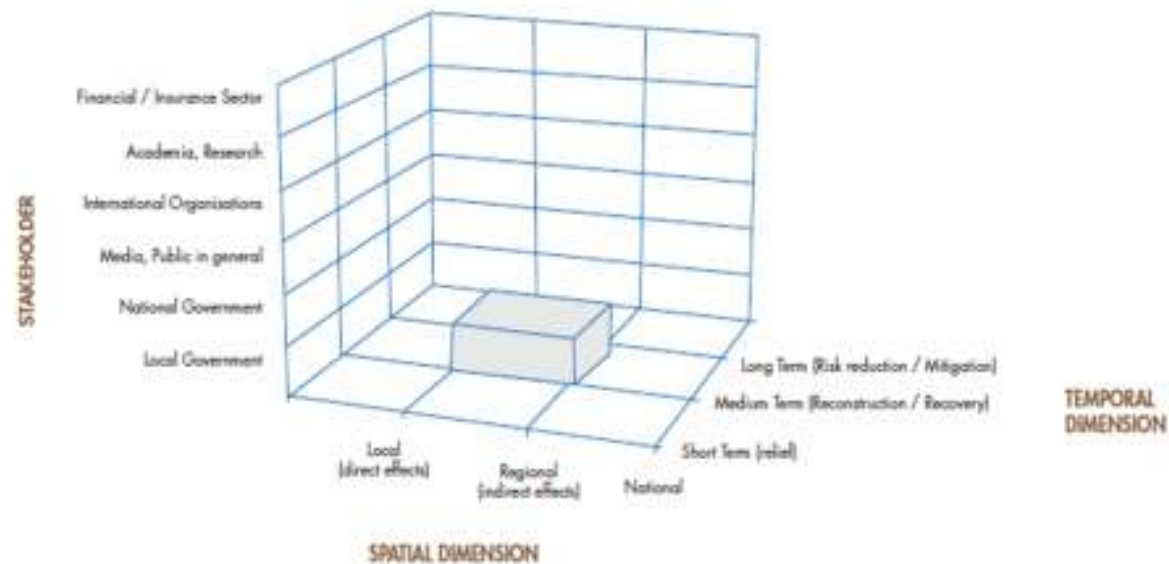
building interaction with  
taxonomies the community  
Risk = Hazard x Vulnerability x Value  
technical communication  
ontology wiki  
DEFINITIONS  
white papers

GEM Ontology and Taxonomy  
Global Exposure Database  
Global Earthquake Consequences Database  
Global Vulnerability Estimation Methods  
Inventory Data Capture Tools



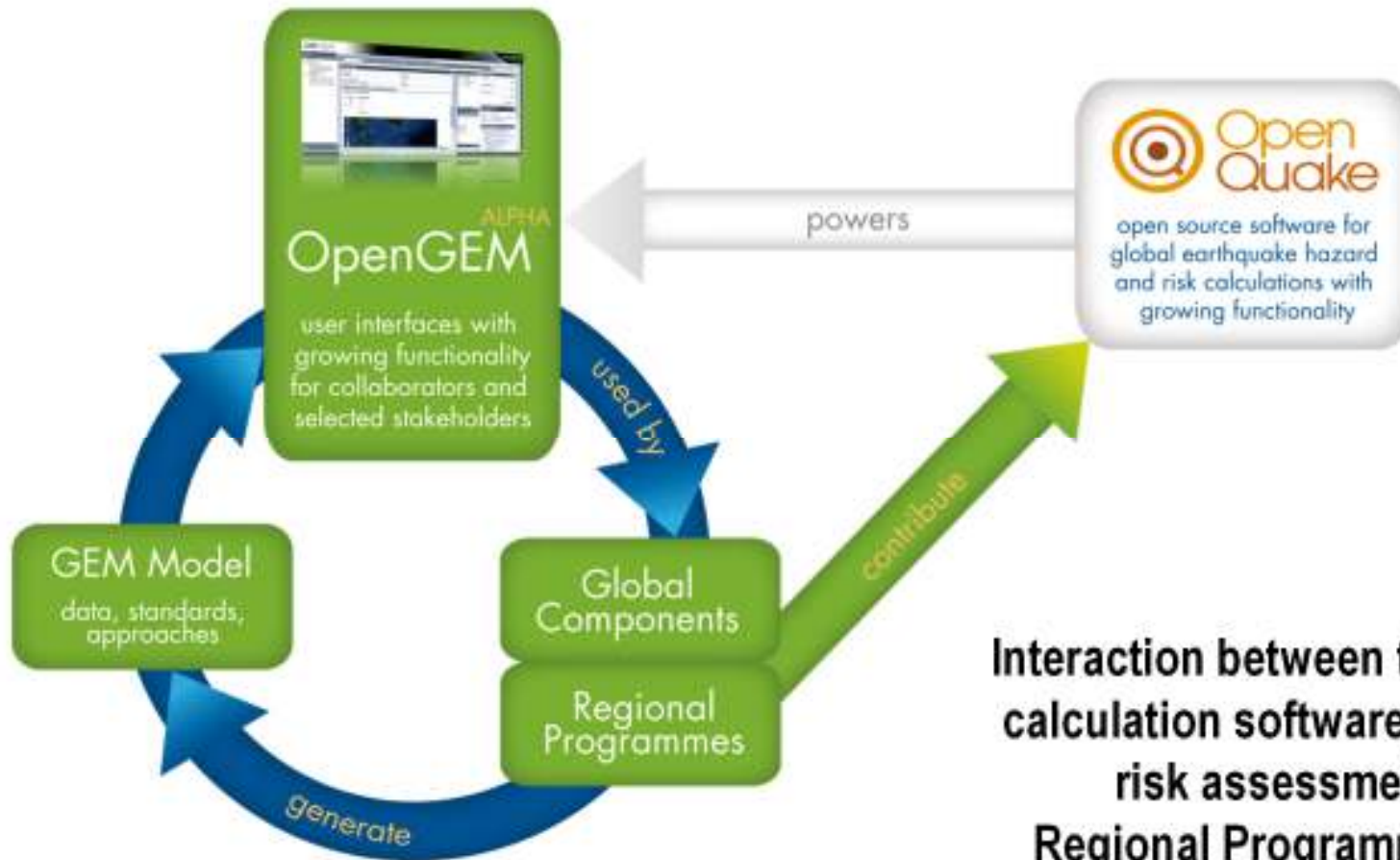
# SOCIO-ECONOMIC IMPACT GLOBAL COMPONENT

- Expert elicitation, 7 workshops and meetings, 1 Request for Proposal (RfP) drafting, community feedback, RfP review and publication
- International consortia submitted 3 proposals (20+ institutions)
- 7 peer reviewers, Scientific Board selection, Governing Board decision.



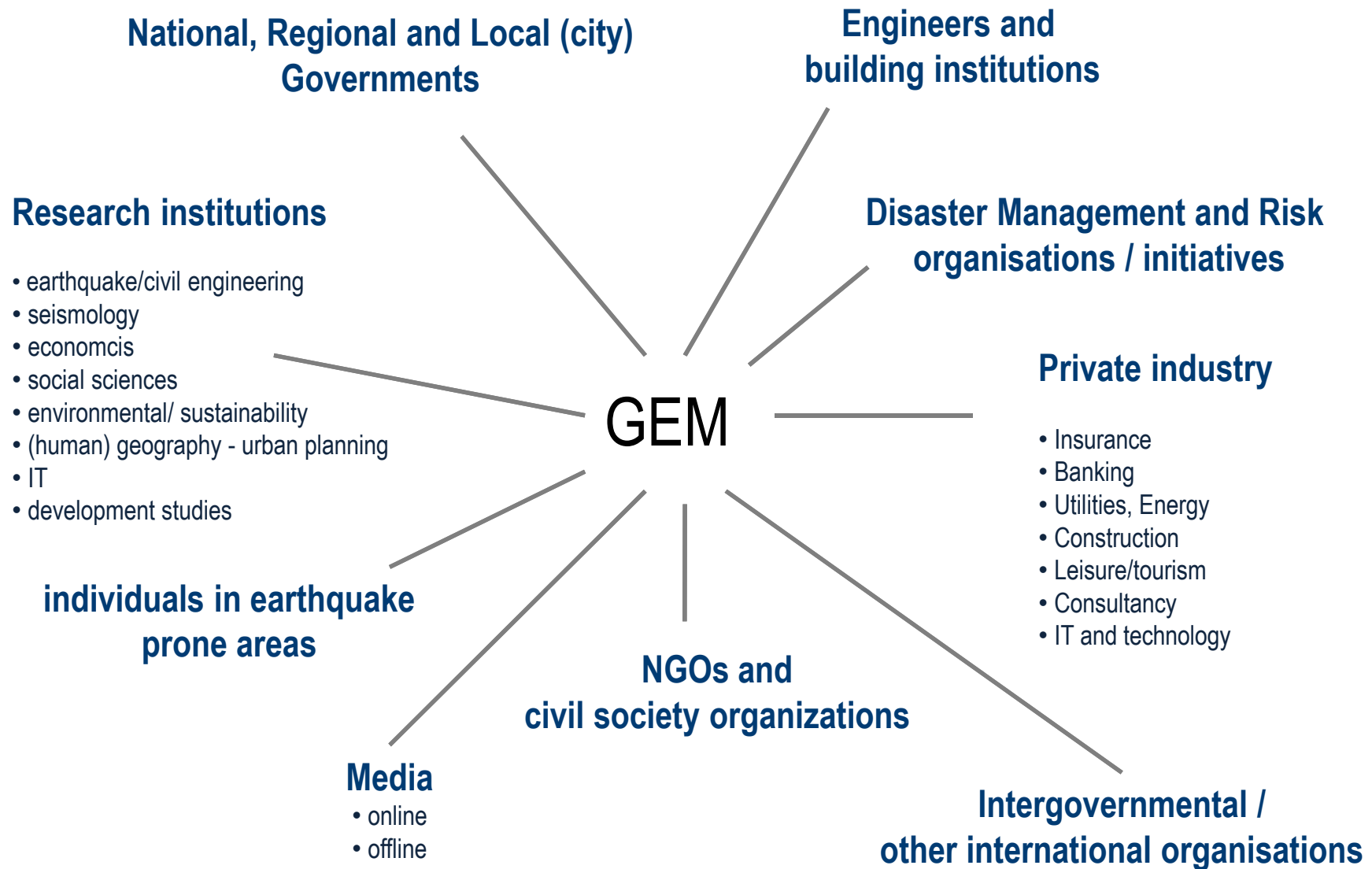


# OPENGEM DEVELOPMENT 2011-2013



**Interaction between the OpenQuake calculation software, the OpenGEM risk assessment platform, the Regional Programmes and Global Components for the development of the GEM model**

# SERVING USERS & BENEFICIARIES





# CONCLUDING: MAIN FEATURES

## ...of a Global Earthquake Risk Model

- It must consist of a state-of-the-art, independent, transparent/open and consistent standard/model to calculate earthquake risk
- It must be dynamic, modular, flexible, expandable (i.e. not a map nor a report)
- It should serve the needs of all possible users, from the general public to the decision makers, communicating risk in an effective manner
- It must stem from a public-private partnership, combining the strengths (and objectives) of both the public and the private sectors
- It needs to be community-based and public-owned, in order to be consensual, accepted and actually used
- It has to feature regional and global coverage and facilitate technology-transfer

# FURTHER INFORMATION



## GEM Website

- Most update source of information
- News, results, calls, ...

## GEM Report 2009/2010

- 36 pages
- Available from website and hard-copy

## Bi-monthly e-Newsletter

- Sign-up at website

## GEM Handout

- Available from website and hard-copy



*Thank you*

**[www.irdrinternational.org](http://www.irdrinternational.org)**

